PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-344751

(43)Date of publication of application : 14.12.2001

(51)Int.Cl. G11B 7/0045

(21)Application number : 2000-162895

(22)Date of filing : 31.05.2000

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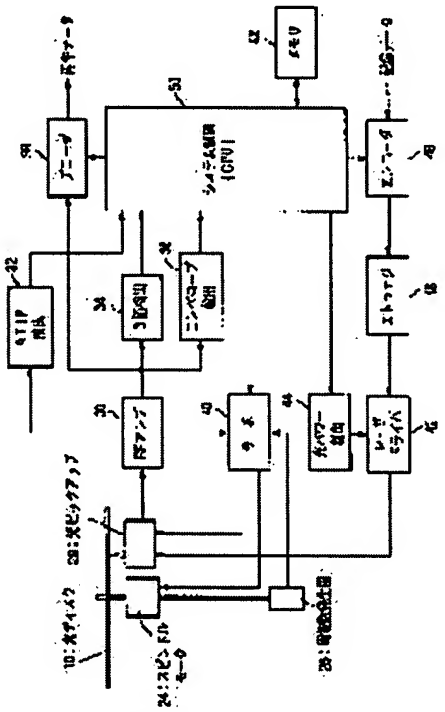
(54) METHOD AND DEVICE FOR RECORDING OPTICAL DISK

(57)Abstract:

PROBLEM TO BE SOLVED: To perform high-definition recording by controlling an optical beam to have proper recording power at each point of time in the case of variably recording a linear velocity power in accordance with the radial direction position of an optical disk.

SOLUTION: The recording power (y) of the optical beam is variably controlled in accordance with a function y=ax+b corresponding to a linear velocity power (x). The value (a) of the function is fixed to a value corresponding to the kind of the disk. Prior to the recording of the optical disk, test recording is performed by one appropriate linear velocity power to obtain an appropriate recording power in the linear speed power. The value of (b) by which the recording power becomes the solution of the function in the linear velocity power is obtained. In actual recording, in accordance with the linear velocity power at each radial direction position, the value of the appropriate recording power is obtained based on the function to control the optical beam to have the obtained recording power value.



LEGAL STATUS

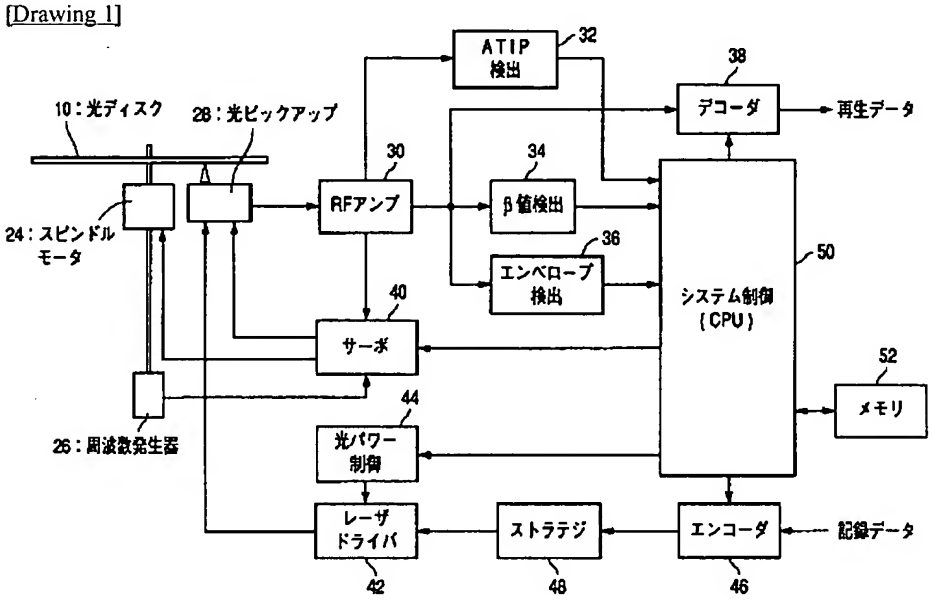
[Date of request for examination]	29.03.2001
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3496628
[Date of registration]	28.11.2003
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

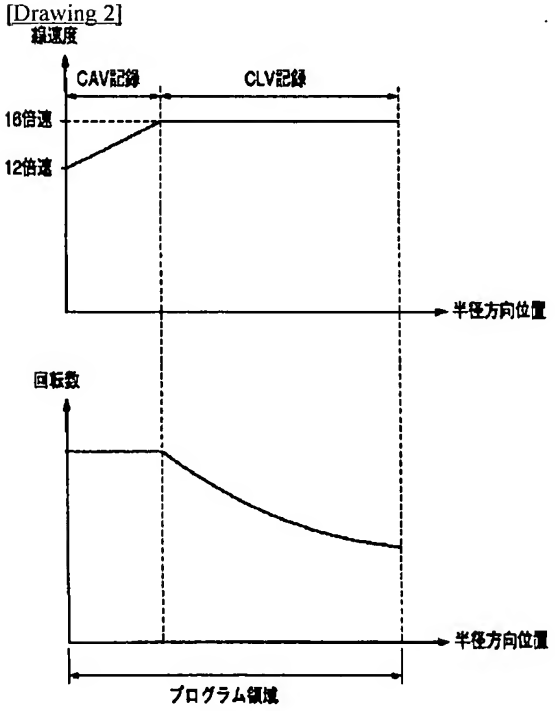
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

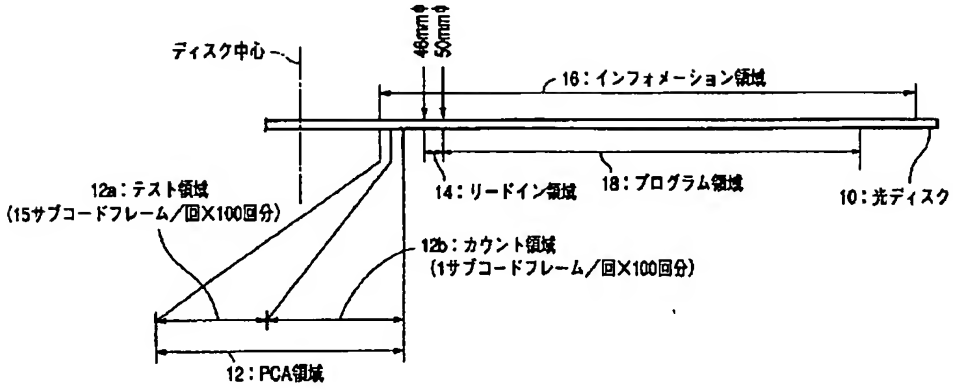
[Drawing 1]



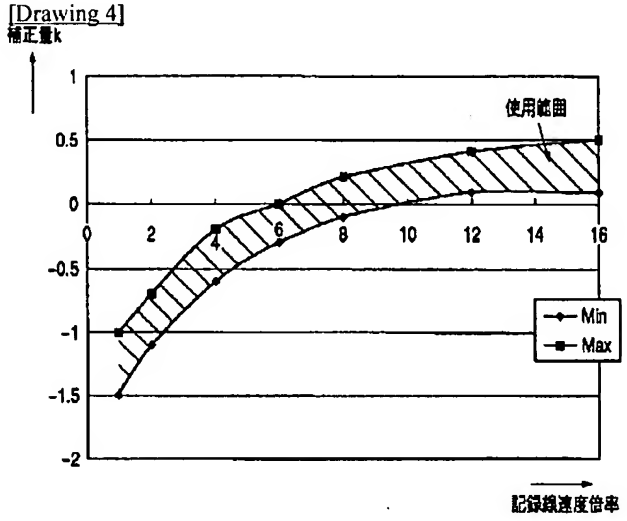
[Drawing 2]



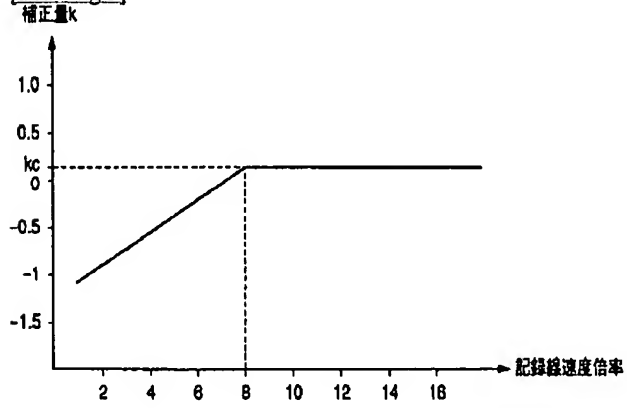
[Drawing 3]



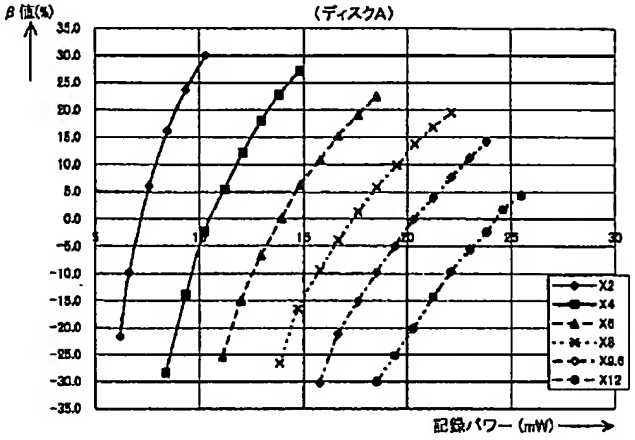
[Drawing 4]



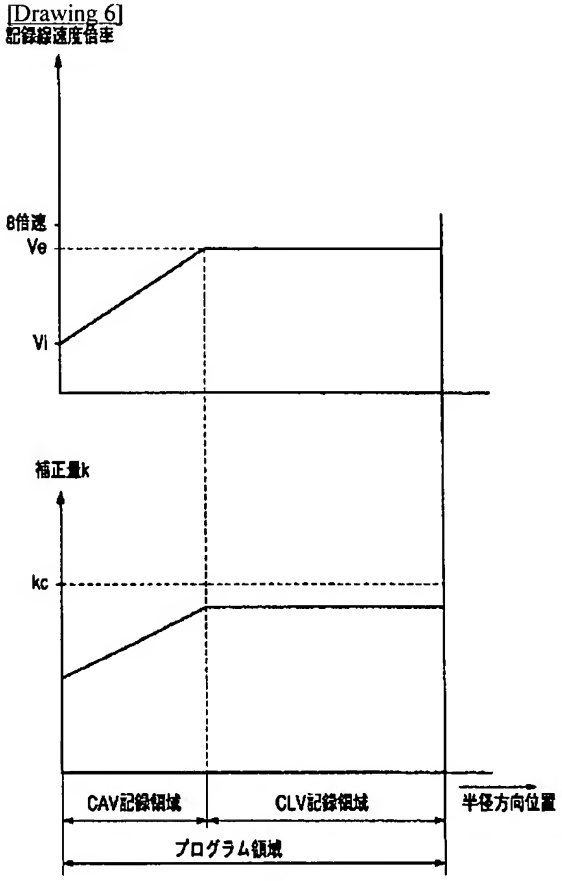
[Drawing 5]



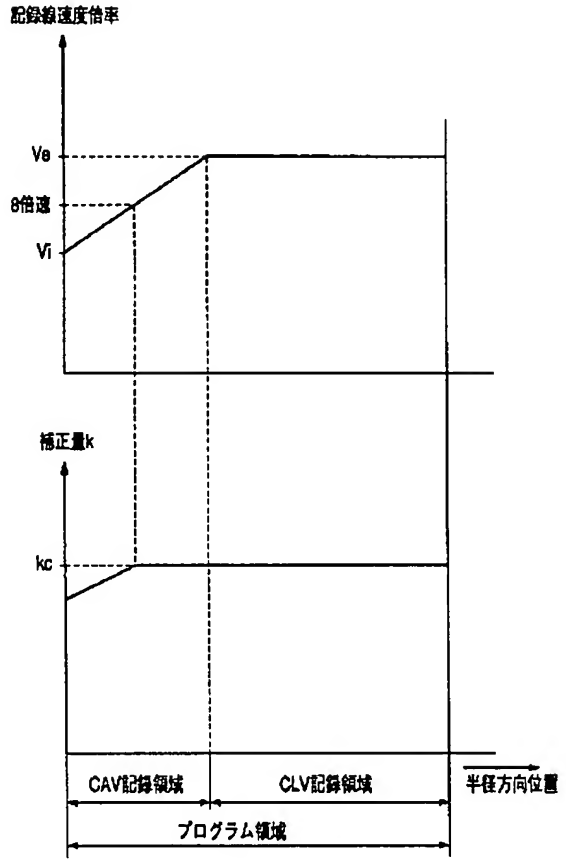
[Drawing 10]



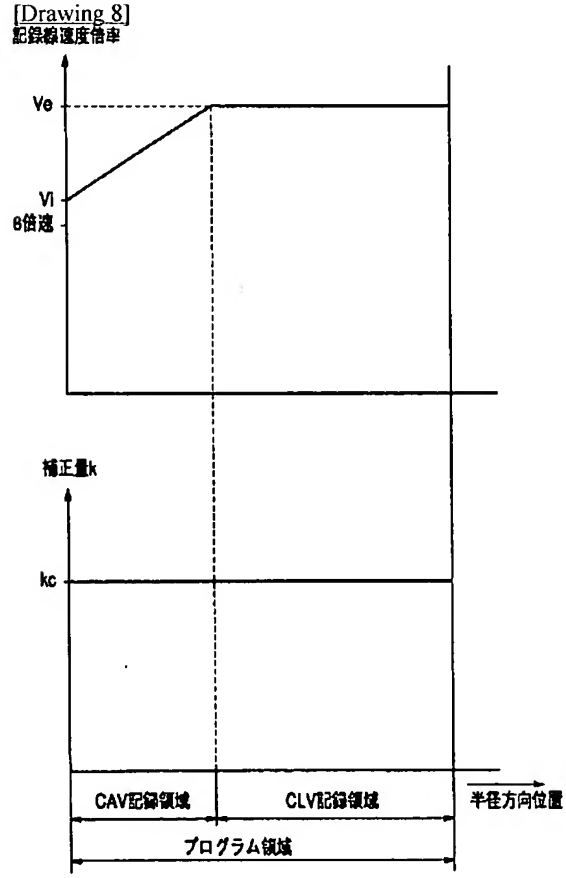
[Drawing 6]



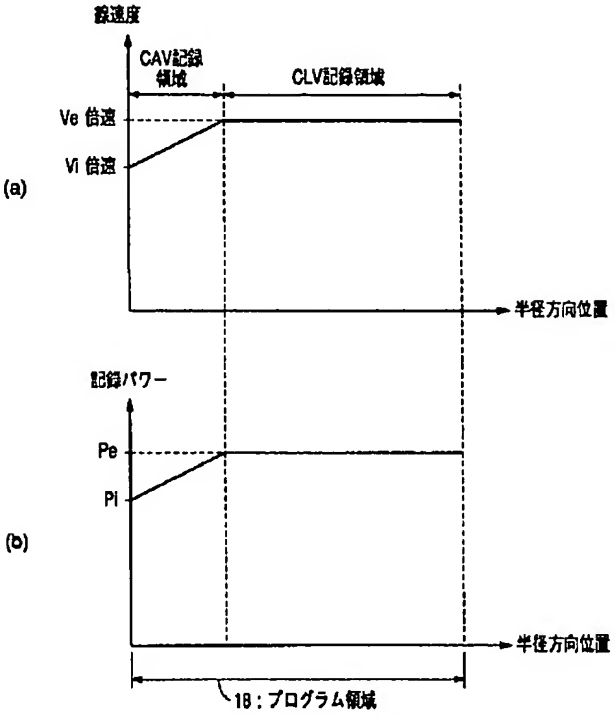
[Drawing 7]



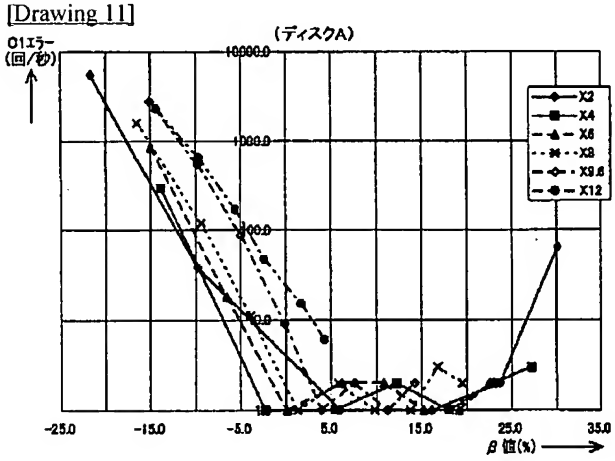
[Drawing 8]



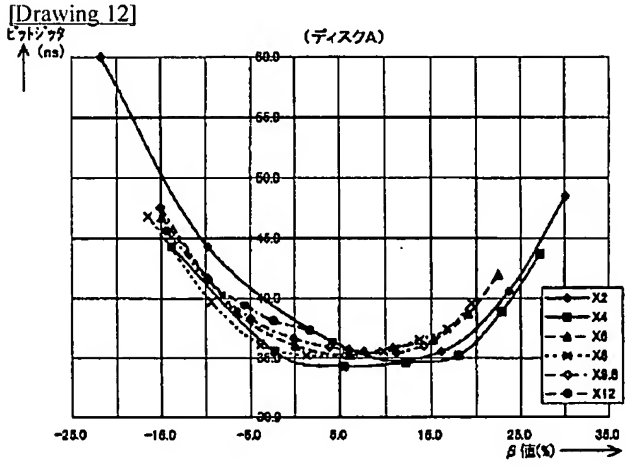
[Drawing 9]



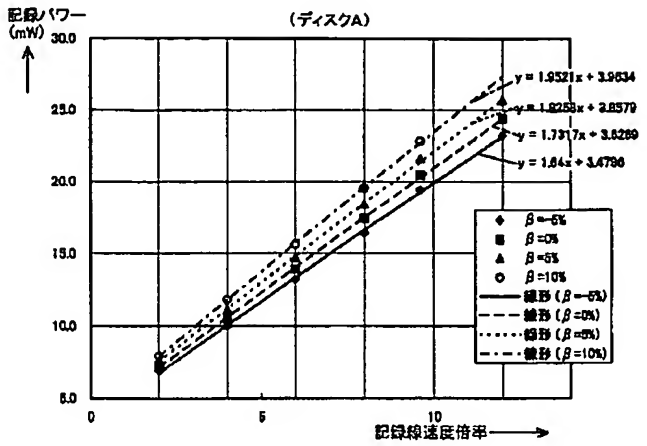
[Drawing 11]



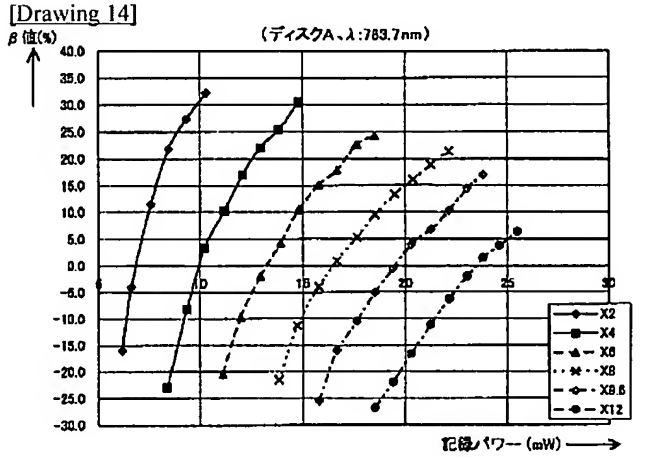
[Drawing 12]



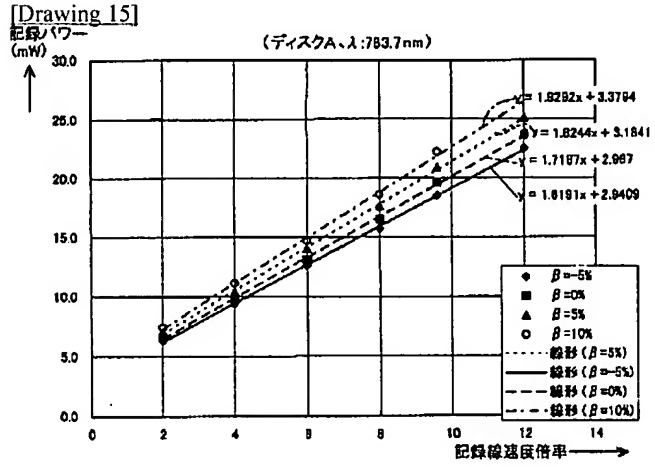
[Drawing 13]



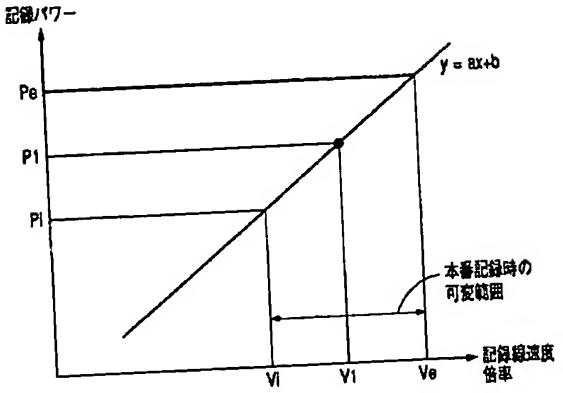
[Drawing 14]



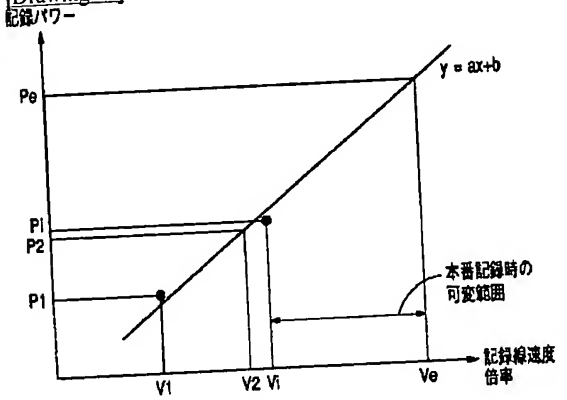
[Drawing 15]



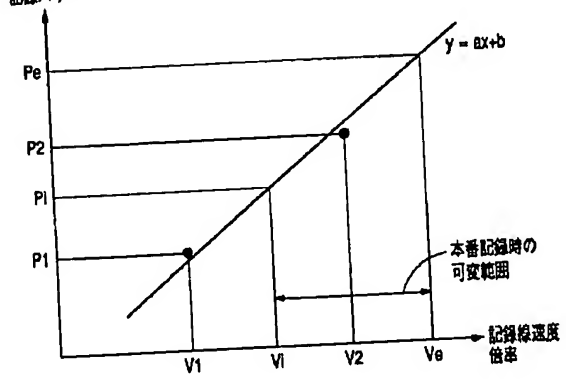
[Drawing 16]



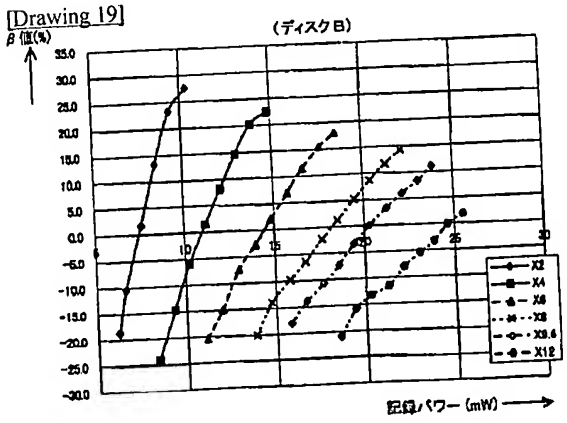
[Drawing 17]



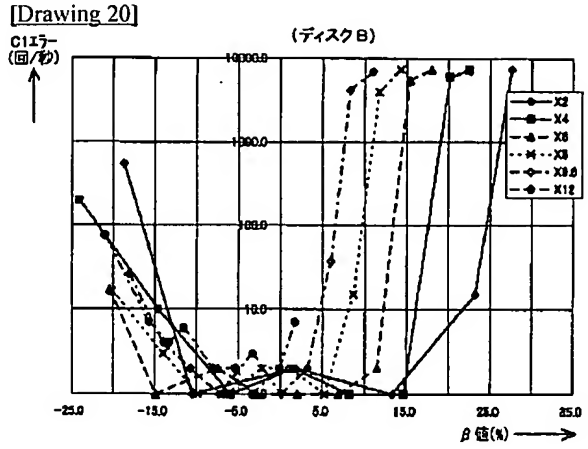
[Drawing 18]



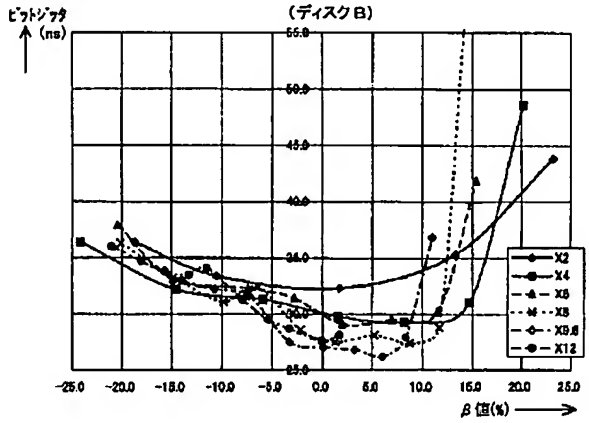
[Drawing 19]



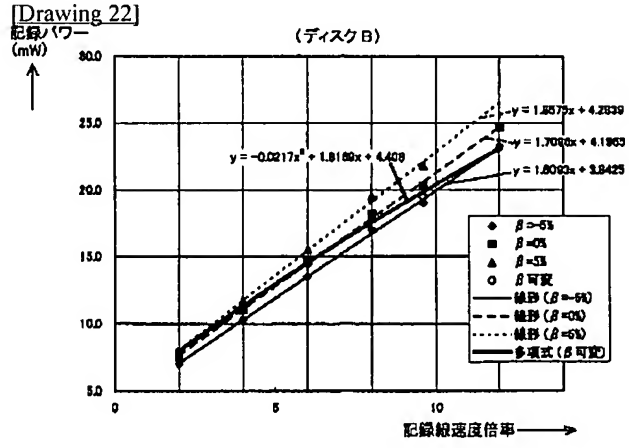
[Drawing 20]



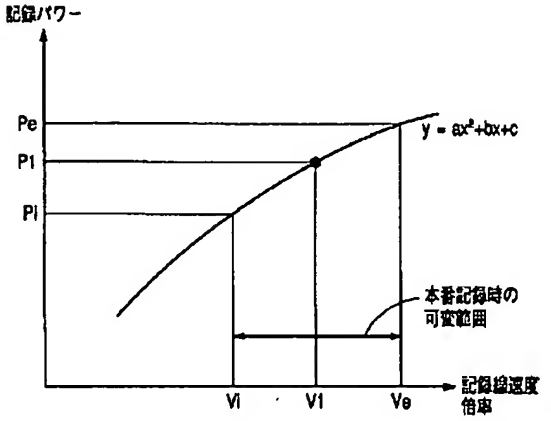
[Drawing 21]



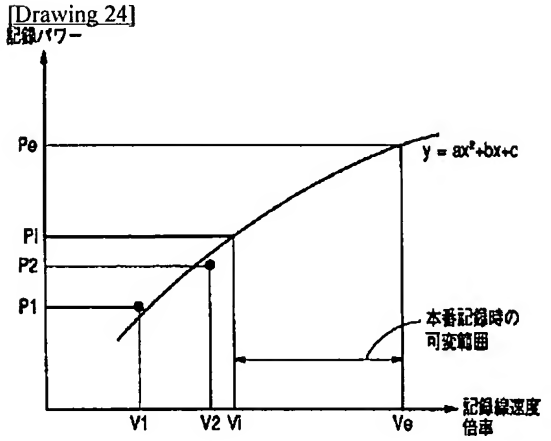
[Drawing 22]



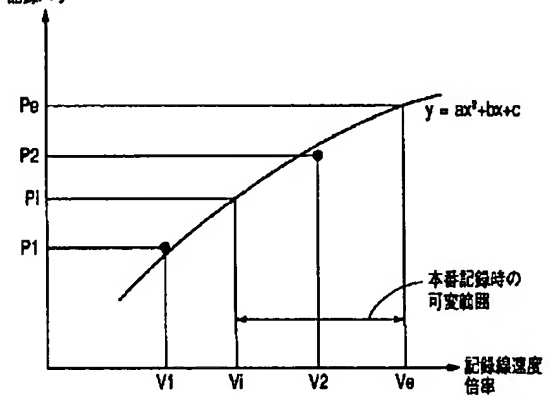
[Drawing 23]



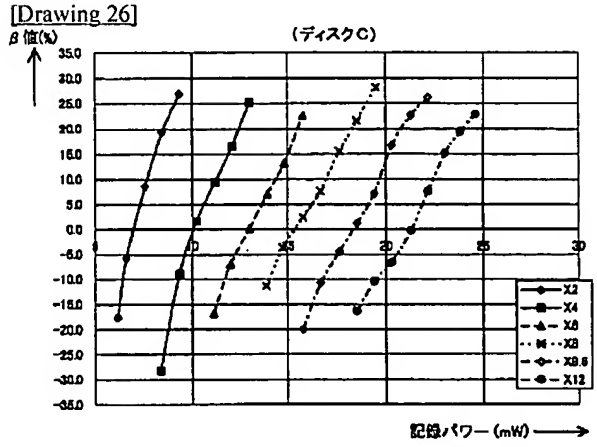
[Drawing 24]



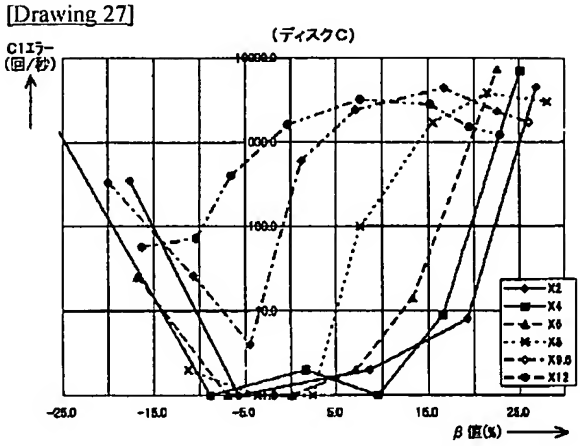
[Drawing 25]



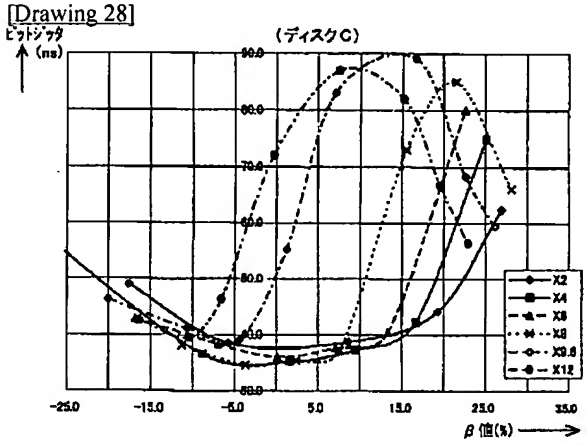
[Drawing 26]



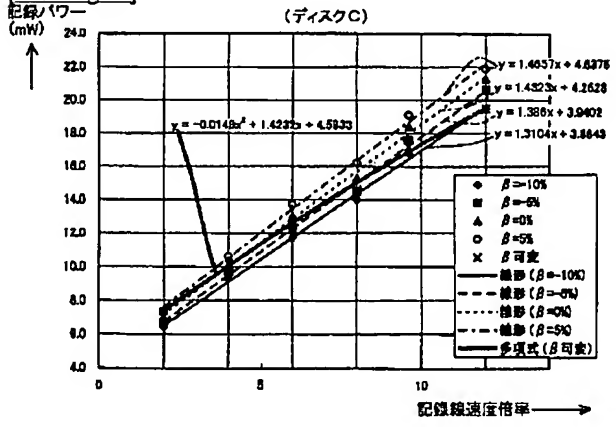
[Drawing 27]



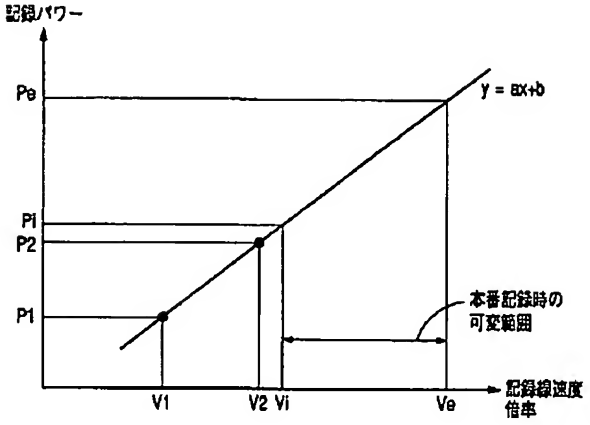
[Drawing 28]



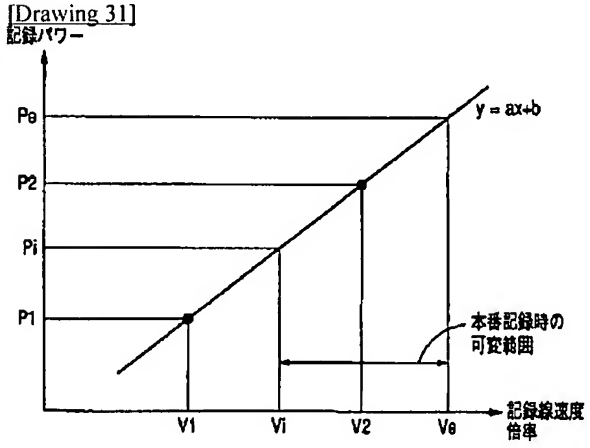
[Drawing 29]



[Drawing 30]



[Drawing 31]



[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] When recording a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk about the record approach of recordable mold optical disks, such as a CD-R (CD recorder bull) disk and a DVD-R (DVD recorder bull) disk, and a recording apparatus, this invention controls the amount of amendments of the record strategy about the irradiation time of a light beam to a proper value, or controls a light beam to proper record power, and enables it to perform high-definition record at each event.

[0002]

[Description of the Prior Art] The high-speed record recorded with a linear velocity higher than a standard linear velocity (one X) as the record approach of constant linear velocity (CLV) record mold optical disks, such as CD-R and DVD-R, may be used.

[0003]

[Problem(s) to be Solved by the Invention] In the inner circumference side of an optical disk, in constant linear velocity record, a spindle rotational frequency becomes high. Especially, in high-speed record, it is remarkable, for example, is set to 8000 or more rpm by the most inner circumference in 16X. For this reason, in the record by the side of disk inner circumference, the self-excited vibration of a drive becomes large (in the case [Especially] of a mass-eccentricity disk), and pit formation becomes instability. Moreover, when the so-called on-the-fly recording which writes in a CD-R drive from another CD-ROM drive, without once creating an image file to a hard disk is performed at high speed, Although there is the approach of making carry out high-speed playback of the CD-ROM drive by rotational-speed regularity (CAV), and recording by carrying out high-speed record of the CD-R drive by the constant linear velocity At a periphery side, even if the linear velocity of the CD-ROM drive by which CAV playback is carried out at this time has about 32X, there is only about 16X, data transfer may stop meeting the deadline at the time of the playback by the side of inner circumference, the so-called buffer under-run may arise, and writing may fail in it in an inner circumference side.

[0004] As an approach of solving these problems, as shown in drawing 2 , an inner circumference side performs record of CD-R by CAV, and the periphery side is considered in how to perform by CLV. That is, if CAV record is started at the rotational frequency at which linear velocity is equivalent to 12X in the most-inner-circumference location of a program field and linear velocity amounts to 16X at this rotational frequency, CLV record will be henceforth performed by 16X. Thus, by switching CAV

record and CLV record, maximum engine speed can be stopped, and ****** self-excited vibration is controlled, and failure of on-the-fly recording is prevented.
[0005] Thus, by the approach of recording by switching CAV record and CLV record, since linear velocity changes at the time of CAV record, the optimal record power of a record light beam carries out sequential change. Moreover, time amount n which is equivalent to T[T (n+k), however]:unit pit length as record strategy about the irradiation time of the light beam for record: The multiple of the pit length which should form over unit pit length (natural number)
k: Although the amount of amendments is used, the proper value of the amount k of amendments also changes with the linear velocity at the time of record.
[0006] This invention tends to offer the optical disk record approach and recording device which control the amount of amendments of the record strategy about the irradiation time of a light beam to a proper value, or control a light beam to proper record power, and enabled it to perform high-definition record at each event, when it was made in view of the above-mentioned point and records a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk.
[0007]
[Means for Solving the Problem] Time amount n which is equivalent to T[T (n+k), however]:unit pit length in the irradiation time of the light beam for record according to the pit length which should form the record approach of the optical disk this invention: It is the multiple (natural number) of the pit length which should form over unit pit length.
k: While making record power of said light beam high in the approach of controlling in the amount of amendments and recording an optical disk as a record linear-velocity scale factor becomes high when recording a linear-velocity scale factor on adjustable Bordering on a predetermined linear-velocity scale factor, according to a linear-velocity scale factor, the value of said amount k of amendments is changed, and it is made to record by fixing the value of this amount k of amendments under at the rate scale factor above this rate scale factor. That is, when according to the experiment of this invention person record power of a light beam was made high as the record linear-velocity scale factor became high so that it may mention later, it turned out that the value of the amount k of amendments from which good regenerative-signal grace is acquired changes a lot in the field where record linear velocity is comparatively low, and it becomes almost fixed in the field where record linear velocity is comparatively high. Then, it enables it to perform high-definition record bordering on a predetermined linear-velocity scale factor in this invention under at that rate scale factor by changing the value of said amount k of amendments according to a linear-velocity scale factor, and recording by fixing the value of this amount k of amendments above this rate scale factor. In this case, although it changed somewhat with classes (the difference in activity coloring matter, difference in a manufacturer, etc.) of optical disk, as for the bordering linear-velocity scale factor, it turned out that it can be set in general as the scale factors (for example, 8X, ten etc. X, etc.) of 8X or more. When recording by changing linear velocity only above a bordering linear-velocity scale factor according to this invention, it can record by fixing the amount k of amendments to constant value. Moreover, when recording a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk and making a bordering linear-velocity scale factor into the intermediate linear-velocity scale factor of this linear-velocity scale-factor adjustable within the limits, when a linear-

velocity scale factor is under a linear-velocity scale factor of this boundary, the amount k of amendments can be changed according to a linear-velocity scale factor, and the amount k of amendments can be fixed to constant value at the time more than the linear-velocity scale factor of this boundary.

[0008] The optical disk record approach of this invention is the approach of recording a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk. In advance of record of an optical disk, a test record is performed, respectively for two or more linear-velocity scale factors lower than the adjustable range of the linear-velocity scale factor used by record of acting before the audience. Based on the proper record power which asked for the proper record power in this each linear-velocity scale factor, and was called for about the linear-velocity scale factor of these plurality, the property of the proper record power to a linear-velocity scale factor is set up. At the time of record of acting before the audience, according to the linear-velocity scale factor in each direction location of a path, a proper record power value is calculated based on said property, and said light beam is controlled to this ** **** record power value. Since it was made to perform a test record for two or more linear-velocity scale factors lower than the adjustable range of the linear-velocity scale factor used by record of acting before the audience, respectively according to this invention, even if it is the case that the linear-velocity scale factor used by record of acting before the audience is high, a test record can be performed at a comparatively low rotational frequency, the self-excited vibration at the time of a test record can be controlled, proper record power can be detected to stability, and acting before the audience can be recorded on high definition. The optical disk record approach of this invention is the approach of recording a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk. In advance of record of an optical disk, a test record is performed, respectively for one linear-velocity scale factor of adjustable within the limits used by record of acting before the audience, and one or more linear-velocity scale factors lower than this adjustable range. Based on the proper record power which asked for the proper record power in this each linear-velocity scale factor, and was called for about the linear-velocity scale factor of these plurality, the property of the proper record power to a linear-velocity scale factor is set up. At the time of record of acting before the audience, according to the linear-velocity scale factor in each direction location of a path, a proper record power value is calculated based on said property, and said light beam is controlled to this ** **** record power value. Since it was made to perform a test record for one linear-velocity scale factor of adjustable within the limits used by record of acting before the audience, and one or more linear-velocity scale factors lower than this adjustable range, respectively according to this invention, a test record can be performed at a rotational frequency comparatively low about at least one point, the self-excited vibration at the time of a test record can be controlled, proper record power can be detected to stability, and acting before the audience can be recorded on high definition. Moreover, since a test record is performed, respectively for the linear-velocity scale factor of adjustable within the limits used by record of acting before the audience, and a linear-velocity scale factor lower than this adjustable range, a test record can be performed for the linear-velocity scale factor left mutually, and errors, such as an inclination, can set up few properties.

[0009] In addition, the property of the above-mentioned proper record power can consist

of one linear function or a function more than secondary [one] easily. In constituting from one linear function, it responds the record power y of a light beam to the linear-velocity scale factor x. According to function y=ax+b, shall carry out adjustable control, and record of an optical disk is preceded. A test record is performed, respectively for the linear-velocity scale factor of adjustable within the limits used by record of acting before the audience, and two linear-velocity scale factors of a linear-velocity scale factor lower than this range (or two linear-velocity scale factors lower than the adjustable range used by record of acting before the audience respectively a test record deed). Ask for the proper record power in this both line rate scale factor, and it sets up in quest of said value of a and b from which this both record power serves as a solution of said function in this each linear-velocity scale factor. A proper record power value shall be calculated based on said function with which said value of a and b was set up according to the linear-velocity scale factor in each direction location of a path at the time of record of acting before the audience, and said light beam shall be controlled to this ** **** record power value.

[0010] The optical disk record approach of this invention is the approach of recording a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk. an according to linear-velocity scale factor x, shall carry out adjustable control of record power y of light beam according to function y=ax+b, and corresponding to disk class fixed [the value of a of this function] value -- carrying out -- record of an optical disk -- preceding -- one proper linear-velocity scale factor -- {-- for example the linear-velocity scale factor of adjustable within the limits used by record of acting before the audience -- or this adjustable out of range Perform a test record by linear-velocity scale-factor} (for example, below this adjustable range), and it asks for the proper record power in the linear-velocity scale factor. The value of said b from which this record power serves as a solution of said function in this linear-velocity scale factor is calculated. A proper record power value is calculated based on said function with which said value of a and b was set up according to the linear-velocity scale factor in each direction location of a path at the time of record of acting before the audience, and said light beam is controlled to this ** **** record power value. The optical disk record approach of this invention is the approach of recording a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk. According to the linear-velocity scale factor x, adjustable control of the record power y of a light beam shall be carried out according to function y=ax+b. Make the value of a of this function into the fixed value according to a disk class, and record of an optical disk is preceded. two proper linear-velocity scale factors (for example, one linear-velocity scale factor of adjustable within the limits used by record of acting before the audience and one linear-velocity scale factor lower than this adjustable range --) Or a test record is performed for two linear-velocity scale factors lower than the adjustable range used by record of acting before the audience. Ask for the proper record power in this both line rate scale factor, and the value of said b from which the sum of squares of the error of this ** **** both record power to the solution of said function in this both line rate scale factor serves as min is calculated. A proper record power value is calculated based on said function with which said value of a and b was set up according to the linear-velocity scale factor in each direction location of a path at the time of record of acting before the audience, and said light beam is controlled to this ** **** record power value. According to the

experiment of this invention person, when the adjustable control of the record power y of a light beam was able to be carried out according to function y=ax+b according to the linear-velocity scale factor x, it turned out that the value of a of this function is made into the fixed value according to a disk class, and the value of b can be set up based on the test record in one proper linear-velocity scale factor for every disk. According to this invention, compared with the case where the value of both a and b is calculated, the measurement error of the value of a can be lessened by the test record by setting it as accuracy beforehand in quest of the value of a. In addition, in this invention, the case where the linear-velocity scale factor carries out sequential change according to the direction location of a path of an optical disk is included by controlling an optical disk to rotational-speed regularity, for example as an approach of recording a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk. Each linear velocity at the event is calculated based on the hour entry read in the engine speed of rotational-speed fixed control, and the wobble of an optical disk in this case, and after this linear velocity reached the predetermined value, it can control and record on a constant linear velocity by the periphery side.

[0011] The time amount n which is equivalent to T[T (n+k), however]:unit pit length in the irradiation time of the light beam for record according to the pit length which should form with the optical power control section which controls the power of the light beam which carries out outgoing radiation from the optical pickup which the optical-disk recording apparatus of this invention irradiates a light beam at the disk servo which carries out revolution actuation of the optical disk, and this optical disk, and performs record and playback, and this optical pickup: It is the multiple (the natural number) of the pit length which should form over unit pit length.

k: As a property of the record power of the strategy section controlled in the amount of amendments, and said light beam to a record linear-velocity scale factor Memorize the property that the record power of this light beam becomes high as a record linear-velocity scale factor becomes high, and as a property of said amount k of amendments over a record linear-velocity scale factor The storage section which memorizes the property that the value of said amount k of amendments changes according to a linear-velocity scale factor under for the linear-velocity scale factor bordering on a predetermined linear-velocity scale factor, and the value of said amount k of amendments is fixed above this rate scale factor, At the time of record of said optical disk, said optical power control section is ordered the record power of a light beam based on the property of the record power of the light beam memorized by said storage section according to a record linear-velocity scale factor. It comes to provide the system control section which performs control which orders said strategy section the amount k of amendments based on the property of the amount k of amendments memorized by this storage section. In this case, said storage section shall have memorized the property of the amount k of amendments over said record linear-velocity scale factor for every disk class, said system control section shall distinguish a disk class, and control which orders said strategy section the amount k of amendments based on the property which corresponds among the properties of the amount k of amendments memorized by said storage section shall be performed.

[0012] The disk servo which the optical disk recording apparatus of this invention is an optical disk recording apparatus which records a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk, and carries out revolution

actuation of said optical disk, The optical pickup which irradiates a light beam and performs record and playback to this optical disk, The optical power control section which controls the power of the light beam which carries out outgoing radiation from this optical pickup, Based on the regenerative signal detected by this optical pickup, the signal grace detecting element which calculates the predetermined parameter value about regenerative-signal grace, and the system control section are provided. This system control section In advance of record of the acting before the audience of said optical disk, a test record is performed, respectively for two or more linear-velocity scale factors lower than the adjustable range of the linear-velocity scale factor used by record of acting before the audience in a predetermined test field. Based on the regenerative signal of each [these] test record, the record power value from which the predetermined parameter about regenerative-signal grace serves as a proper value is calculated, respectively. Based on the proper record power called for about the linear-velocity scale factor of these plurality, the property of the proper record power to a linear-velocity scale factor is set up. At the time of record of acting before the audience, a proper record power value is calculated based on said property according to the linear-velocity scale factor in each direction location of a path, and control which orders it this ** **** record power value is performed to said optical power control section.

[0013] The disk servo which the optical disk recording apparatus of this invention is an optical disk recording apparatus which records a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk, and carries out revolution actuation of said optical disk, The optical pickup which irradiates a light beam and performs record and playback to this optical disk, The optical power control section which controls the power of the light beam which carries out outgoing radiation from this optical pickup, Based on the regenerative signal detected by this optical pickup, the signal grace detecting element which calculates the predetermined parameter value about regenerative-signal grace, and the system control section are provided. This system control section In advance of record of the acting before the audience of said optical disk, a test record is performed, respectively for one linear-velocity scale factor of adjustable within the limits used by record of acting before the audience in a predetermined test field, and one or more linear-velocity scale factors lower than this adjustable range. Based on the regenerative signal of each [these] test record, the record power value from which the predetermined parameter about regenerative-signal grace serves as a proper value is calculated, respectively. Based on the proper record power called for about the linear-velocity scale factor of these plurality, the property of the proper record power to a linear-velocity scale factor is set up. At the time of record of acting before the audience, a proper record power value is calculated based on said property according to the linear-velocity scale factor in each direction location of a path, and control which orders it this ** **** record power value is performed to said optical power control section.

[0014] The disk servo which the optical disk recording apparatus of this invention is an optical disk recording apparatus which records a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk, and carries out revolution actuation of said optical disk, The optical pickup which irradiates a light beam and performs record and playback to this optical disk, The optical power control section which controls the power of the light beam which carries out outgoing radiation from this optical pickup, The signal grace detecting element which calculates the predetermined

parameter value about regenerative-signal grace based on the regenerative signal detected by this optical pickup, As a property of the record power y of said light beam to the record linear-velocity scale factor x The storage section which memorizes the fixed value according to a disk class, and the system control section are provided. Function y=ax+b, however a : this system control section In advance of record of the acting before the audience of said optical disk, a test record is performed for one proper linear-velocity scale factor in a predetermined test field. Based on the regenerative signal of this test record, the record power value from which the predetermined parameter about regenerative-signal grace serves as a proper value is calculated. The value of said b from which this record power serves as a solution of said function in this linear-velocity scale factor is calculated. At the time of record of acting before the audience, a proper record power value is calculated based on said function according to the linear-velocity scale factor in each direction location of a path, and control which orders it this ** **** record power value is performed to said optical power control section.

[0015] The disk servo which the optical disk recording apparatus of this invention is an optical disk recording apparatus which records a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk, and carries out revolution actuation of said optical disk, The optical pickup which irradiates a light beam and performs record and playback to this optical disk, The optical power control section which controls the power of the light beam which carries out outgoing radiation from this optical pickup, The signal grace detecting element which calculates the predetermined parameter value about regenerative-signal grace based on the regenerative signal detected by this optical pickup, As a property of the record power y of said light beam to the record linear-velocity scale factor x The storage section which memorizes the fixed value according to a disk class, and the system control section are provided. Function y=ax+b, however a : this system control section In advance of record of the acting before the audience of said optical disk, a test record is performed for two proper linear-velocity scale factors in a predetermined test field. Based on the regenerative signal of these test records, the record power value from which the predetermined parameter about regenerative-signal grace serves as a proper value is calculated, respectively. The value of said b from which the sum of squares of the error of this ** **** both record power to the solution of said function in this both line rate scale factor serves as min is calculated. At the time of record of acting before the audience, a proper record power value is calculated based on said function according to the linear-velocity scale factor in each direction location of a path, and control which orders it this ** **** record power value is performed to said optical power control section.

[0016] The disk servo which the optical disk recording apparatus of this invention is an optical disk recording apparatus which records a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk, and carries out revolution actuation of said optical disk, The optical pickup which irradiates a light beam and performs record and playback to this optical disk, The optical power control section which controls the power of the light beam which carries out outgoing radiation from this optical pickup, The signal grace detecting element which calculates the predetermined parameter value about regenerative-signal grace based on the regenerative signal detected by this optical pickup, As a property of the record power y of said light beam to the record linear-velocity scale factor x The storage section which memorizes the fixed value

according to a disk class, and the system control section are provided. Function y=ax2+bx+c, however a, b : this system control section In advance of record of the acting before the audience of said optical disk, a test record is performed for one proper linear-velocity scale factor in a predetermined test field. Based on the regenerative signal of this test record, the record power value from which the predetermined parameter about regenerative-signal grace serves as a proper value is calculated. The value of said c from which this record power serves as a solution of said function in this linear-velocity scale factor is calculated. At the time of record of acting before the audience, a proper record power value is calculated based on said function according to the linear-velocity scale factor in each direction location of a path, and control which orders it this ** **** record power value is performed to said optical power control section.

[0017] The disk servo which the optical disk recording apparatus of this invention is an optical disk recording apparatus which records a linear-velocity scale factor on adjustable according to the direction location of a path of an optical disk, and carries out revolution actuation of said optical disk, The optical pickup which irradiates a light beam and performs record and playback to this optical disk, The optical power control section which controls the power of the light beam which carries out outgoing radiation from this optical pickup, The signal grace detecting element which calculates the predetermined parameter value about regenerative-signal grace based on the regenerative signal detected by this optical pickup, As a property of the record power y of said light beam to the record linear-velocity scale factor x The storage section which memorizes the fixed value according to a disk class, and the system control section are provided. Function y=ax2+bx+c, however a, b : this system control section In advance of record of the acting before the audience of said optical disk, a test record is performed for two proper linear-velocity scale factors in a predetermined test field. Based on the regenerative signal of these test records, the record power value from which the predetermined parameter about regenerative-signal grace serves as a proper value is calculated, respectively. The value of said c from which the sum of squares of the error of this ** **** both record power to the solution of said function in this both line rate scale factor serves as min is calculated. At the time of record of acting before the audience, a proper record power value is calculated based on said function according to the linear-velocity scale factor in each direction location of a path, and control which orders it this ** **** record power value is performed to said optical power control section.

[0018] In addition, for example said storage section shall have memorized the property of the record power y of the light beam to said record linear-velocity scale factor x for every disk class, said system control section shall distinguish a disk class, and control which orders it the record power y of a light beam based on the property which corresponds among the properties of the record power y of the light beam memorized by said storage section shall perform in the optical disk recording apparatus of this invention. moreover -- for example, said system control section -- said disk servo -- receiving -- a boundary [location / proper / of said optical disk / of a path / direction] -- carrying out -- the inner circumference side -- rotational speed -- the command which drives uniformly and is driven to a constant linear velocity by the periphery side with the linear-velocity scale-factor final value in this rotational-speed fixed control shall be emitted Moreover, the optical disk recording apparatus of this invention is [0019] which shall be controlled and recorded on a constant linear velocity by the periphery side after providing further the

hour entry reading section which reads a hour entry in the wobble of said optical disk, said system control section's calculating each linear velocity at the event based on the hour entry read in the engine speed of said rotational-speed fixed control, and the wobble of said optical disk and this linear velocity's reaching a predetermined value. Moreover, in this invention, a test record can be performed by PCA (Power Calibration Area: power calibration field) of for example, the disk most inner circumference. Moreover, this invention is applicable to record of pigment system postscript mold constant linear velocity optical disks, such as a CD-R disk and a DVD-R disk, and the other various optical disks which can apply this invention.

[0020]

[Embodiment of the Invention] The gestalt of implementation of this invention is explained below. Here, in case a CD-R disk is switched to CAV record and CLV record and is recorded according to that direction location of a path, the case where this invention is applied is explained. Field division of a CD-R disk is shown in drawing 3 . The section with a diameter of 46-50mm is prepared as a lead-in groove field 14, and, as for the optical disk 10 (CD-R disk), the PCA field (Power Calibration Area: power calibration field) 12 is prepared for the inner circumference side rather than it. The PCA field 12 consists of test field 12a and count area 12b. The test record of OPC (Optimum Power Control: optimal record power adjustment of a record beam) is performed to test field 12a. This test record changes record power to 15 steps, performs 1 time of a test record, it records the EFM signal for 1 sub-code frame (it does not restrict to this) per record power, records the EFM signal for a total of 15 sub-code frame, and is performed. The capacity (for example, 1500 sub-code frame) which performs this test record 100 batches (it is OPC100 batch since a test record is performed once by 1 time of OPC), for example is assigned to test field 12a. Whenever OPC is performed to count area 12b, the EFM signal for 1 sub-code frame is recorded. The capacity for the same count of OPC as test field 12a (for example, if it is OPC100 batch 100 sub-code frame) is assigned to count area 12b. In case OPC is performed, it detects how far the EFM signal of count area 12b is recorded beforehand, and it is judged where [in test field 12a] this test record should be performed from.

[0021] The lead-in groove field 14 is adjoined and the program field 18 is prepared for the periphery side. The hour entry etc. is recorded on the wobble of the truck (PURIGURUBU) of the information field 16 whole as ATIP information. As for the ATIP hour entry, the value (it decreases simply) on which the value (it increases simply) which continued to the periphery side edge section of the information field 16 was recorded and which it followed to the inner circumference side edge section of the information field 16 in the inner circumference side is recorded on the basis of the starting position of the program field 18 at the periphery side. A lead-out field is formed immediately after the trailer (location which closed record) of the program field 18.

[0022] The gestalt of operation of the optical disk recording device of this invention is shown in drawing 1 . Revolution actuation of the optical disk 10 (CD-R disk) is carried out with a spindle motor 24. The rotational frequency of a spindle motor 24 is detected by the frequency generator 26. An optical pickup 28 irradiates a light beam (laser beam) at an optical disk 10, and performs informational record and playback. The return light light-receiving signal (EFM signal) of an optical pickup 28 is supplied to RF amplifier 30. The ATIP detector 32 extracts a wobble signal component from an EFM signal, and

decodes the ATIP information further included in this wobble signal component. The identification information (disk ID) which shows the hour entry (address information) and disk class of each location is contained in ATIP information. The beta value detector 34 computes a beta value (asymmetry value) as a parameter about regenerative-signal grace from an EFM signal wave form. If a beta value sets the peak level (a sign is +) of a playback EFM signal wave form to a and sets a bottom level to b (a sign is -), it can be found in (a+b)/(a-b). The envelope detector 36 detects the envelope of an EFM signal. It is used for detecting whether the EFM signal is beforehand recorded by the count area 12b (drawing 3) throat top in case this envelope detection performs OPC. A decoder 38 carries out the EFM recovery of the EFM signal, and obtains playback data.

[0023] The servo circuit 40 performs each control of the roll control of a spindle motor 24 and the focus of an optical pickup 28, tracking, and delivery. Control of a spindle motor 24 is performed by switching CAV control and CLV control according to the direction location of a path. CAV control is performed when the rotational frequency detected by the frequency generator 26 controls a spindle motor 24 in agreement with the set-up rotational frequency. CLV control is performed by controlling a spindle motor 24 so that the wobble signal detected from an EFM signal becomes the set-up linear-velocity scale factor. A laser driver 42 drives the source of laser in an optical pickup 28. The optical power control circuit 44 controls a laser driver 42, and controls the laser power at the time of record and playback (at the time of a test record and record of acting before the audience). Eight-to-fourteen modulation of the record data is carried out with an encoder 46, amendment processing of the time-axis is carried out in the strategy circuit 48, and they modulate the laser driving signal of a laser driver 42. Informational record is performed by driving the source of laser of an optical pickup 28 with this modulated laser driving signal. At the time of playback, a laser driver 42 drives the source of laser of an optical pickup 28 by predetermined playback power. Memory 52 consisted of flash ROMs etc. and has memorized the property of the correction value k of the record strategy to a record linear-velocity scale factor, and the property of the record power to a record linear-velocity scale factor for every disk ID. Such property information can be updated by download.

[0024] The system control circuit 50 (CPU) controls this whole optical disk recording device. Especially the system control circuit 50 performs the next control about this invention.

(a) Distinguish a disk class based on the disk ID detected in the ATIP detector 32, and specify the property which corresponds among the property of the amount k of amendments of the record strategy memorized by memory 52, and the property of the record power of a light beam.

(b) In advance of record of the acting before the audience of an optical disk 10, the beta value which performs a test record in the PCA field 12, and is detected in the beta value detector 34 based on the regenerative signal of this test record calculates the record power value used as a proper value, and sets up the undecided constant in the characteristic function of the record power of a light beam based on this measurement.

(c) Calculate each linear-velocity scale factor at the event based on the hour entry detected in the command engine speeds (engine-speed upper limit beforehand set as the drive) and the ATIP detector 32 of rotational-speed fixed control at the time of record of acting before the audience. To the servo circuit 40 by the inner circumference side before

this linear-velocity scale factor reaches a command linear-velocity scale factor (linear-velocity scale factor ordered by the user etc.) It is ordered rotational-speed fixed actuation at this command rotational frequency, and after this linear-velocity scale factor reached this command linear-velocity scale factor, it is ordered constant linear velocity actuation for this command linear-velocity scale factor by the periphery side. In this case, each linear-velocity scale factor V at the event is called for by the operation of for example, a degree type.

[0025] The command engine speed VCLV of V=2piR-VCAV/VCLV, however radius value VCAV:rotational-speed fixed control of R:relevance location: The radius value R of an applicable location is calculated by the operation of for example, a degree type by the linear velocity of a disk proper, in addition the top formula.

R= {(T-P-VCLV/pi) +R02} -- the track pitch R0:program field most-inner-circumference radius of 1/2, however the ATIP hour entry P:disk proper of T:relevance location -- for example When the case where CAV actuation is carried out by VCAV=6000rpm is assumed using P= 1.6 micrometers and a VCLV=1.2m/second disk, the radius value R of the location of 00 frames for T= 5 minutes and 00 seconds R= [{(5-60) -(1.6-10-3) -(1.2-103)/pi}+252] Since it is 1 / 2= 28.43mm, the linear-velocity scale factor V in the location can be found as V=2pi and 28.43-(6000/60)/(1.2-103) =14.88 X. In addition, the linear velocity VCLV of a disk proper and the value of the track pitch P of a disk proper are acquirable by measuring before record of acting before the audience, or memorizing these values for every disk class in memory 52, after inserting an optical disk 10 for example, in an optical disk recording apparatus.

(d) At the time of record of acting before the audience, according to a record linear-velocity scale factor, order the optical power control circuit 44 the record power of a light beam based on the property of the record power of a light beam, and order the strategy circuit 48 the amount k of amendments based on the property of the amount k of amendments of record strategy.

[0026] In addition, in the case of the disk class the optical disk 10 is not remembered to be by memory 52, the system control circuit 50 performs a test record about at least two linear-velocity scale factors, and the whole property of the record power of the light beam to a record linear-velocity scale factor is set up. Moreover, about the amount k of amendments of record strategy, the standard property is memorized in memory 52, for example at this time, and it is used.

[0027] Adjustment of the amount of amendments of the irradiation time of the light beam for record by the optical disk recording apparatus of drawing 1 is explained. Time amount n which is equivalent to T[T (n+k), however]:unit pit length in the irradiation time of the light beam for record according to the bit length which should form the strategy circuit 48: It is the multiple (natural number of 3-11) of the pit length which should form over unit pit length.

k: Control in the amount of amendments. Drawing 4 is in the condition which kept proper the power (record power) of the light beam for record, and when a record linear-velocity scale factor is changed and is recorded, it shows the range of the amount k of amendments (field shown by hatching) where properties, such as C1 error of a regenerative signal and a jitter, become good. According to this, more than by it, although the range of proper k value [less than / it / as opposed to / bordering on about 8 scale factors / a record linear-velocity scale factor in a record linear-velocity scale factor] is

changed sharply, even if a record linear-velocity scale factor changes, it turns out that the range of proper k value seldom changes. The example of a property of the amount k of amendments by the strategy circuit 48 in the case of using the optical disk of the property of drawing 4 is shown in drawing 5 . As a bordering linear-velocity scale factor, the amount k of amendments is changed in the shape of a straight line (or a curve-like is sufficient), corresponding to a record linear-velocity scale factor in less than 8X at the property of drawing 5 , and 8X is made into constant value kc for it by 8X or more. In addition, the property of the amount k of amendments for every disk class is beforehand memorized in memory 52, and it is used, reading the property which corresponds according to the disk ID detected.

[0028] The property of the amount k of amendments of drawing 5 is used, and change of the linear-velocity scale factor to the direction location of the diameter of a disk and the amount k of amendments in the case of switching and recording CAV record and CLV record is shown in drawing 6 - drawing 8 . as for drawing 6 , the linear-velocity scale factor of CAV record always shows the linear-velocity scale-factor initial value of CAV record by the case of 8X or less, as for (Vi, and, as for Ve, this linear-velocity scale-factor final value is shown.) -- the amount k of amendments carries out rear-spring-supporter change in the whole CAV record section at this time. By the case where, as for drawing 7 , the linear-velocity scale factor of CAV record changes on both sides of 8X, at this time, after the amount k of amendments amounted to 8X, it is fixed to constant value kc. As for drawing 8 , the linear-velocity scale factor of CAV record is always fixed to the rear-spring-supporter constant value kc throughout a program field by the case of 8X or more at this time, as for the amount kc of amendments.

[0029] Next, power control of the light beam for record by the optical disk recording apparatus of drawing 1 is explained. Here, it records by changing a record linear-velocity scale factor like drawing 9 (a). That is, the linear-velocity scale factor of CLV record is set as Ve (linear-velocity scale factor ordered by the user etc.), and CAV record is carried out at this command engine speed about the field by the side of the inner circumference from which an engine speed becomes beyond command values (engine-speed upper limit beforehand set as the drive) for this linear-velocity scale factor Ve among the program fields 18. Vi and the linear-velocity scale-factor final value of the linear-velocity scale-factor initial value of this CAV record are Ve(s). Drawing 9 (b) shows change of the record power of the light beam at this time. In a CAV record section, record power goes up with lifting of a linear-velocity scale factor (for the record power in the linear-velocity scale-factor initial value Vi, the record power in Pi and the linear-velocity scale-factor final value Ve is Pe), and if a CLV record section is arrived at, record power will become fixed at Pe.

[0030] An example is explained about how to ask for the record power characteristics to the record linear-velocity scale factor in the case of recording by controlling a record linear-velocity scale factor and record power like drawing 9 .

[Example 1] Example drawing 10 at the time of using the super cyanine system CD-R disk (following the "disk A") of A company shows the property of the beta value of the playback RF signal to the record power at the time of changing record power variously and recording it in various linear-velocity scale factors, using Disk A. Drawing 11 shows the property of C1 error over the beta value when carrying out the EFM recovery of this playback RF signal. Drawing 12 shows the property of the pit jitter to the beta value of

this playback RF signal. Drawing 13 is the property of the record power to the record linear-velocity scale factor for every beta value of having developed and searched for the property of drawing 10 . According to drawing 13 , the property of the record power to the linear-velocity scale factor at the time of maintaining and recording a beta value on a predetermined value can be approximated for linear-function y=ax+b, however a y:record power x:linear-velocity scale factor. Moreover, according to drawing 11 and drawing 12 , in the case of Disk A, it cannot be based on a record linear-velocity scale factor, but the desired value (target beta) of a beta value can be set as constant value also in the time of high-speed record by one with a sufficiently large (the range of a beta value when C1 error and a pit jitter are low is wide) power margin. Therefore, when the desired value of a beta value is set up uniformly 5%, for example, drawing 13 shows that the value of a (inclination) of characteristic function y=ax+b of the record power to a record linear-velocity scale factor and b (y intercept) can be set as a= 1.8258 and b= 3.8579.

[0031] Although the property of drawing 10 is the case where the wavelength of a light beam is 787nm, since the wavelength of a light beam differs somewhat for every drive, it needs to consider the effect by the difference in this wavelength. Drawing 14 shows the property of the beta value of the playback RF signal to record power when the wavelength of a light beam changes record power to Disk A variously and records it on it for various linear-velocity scale factors using the drive which is 783.7nm. Drawing 15 is the property of the record power to the record linear-velocity scale factor for every beta value of having developed and searched for the property of drawing 14 . According to drawing 15 , the value of a of function y=ax+b in case a beta value is 5%, and b is set to a= 1.8244 and b= 3.1841. If the value of a in case these values and the beta value by drawing 13 are 5%, and b is compared, the value of a will be almost equal and the value of b will change comparatively a lot. Therefore, the value of a is immobilization and this result shows that what is necessary is just to change only the value of b, even if the wavelength of a light beam differs somewhat. Then, y=ax+b (a is immobilization and b is undecided) is beforehand memorized in memory 52 as a characteristic function of the record power to the record linear-velocity scale factor about Disk A, a test record (OPC) is performed in advance of record of acting before the audience, and the value of b is set up.

[0032] The example of the technique set up in quest of the value of b by the test record is explained.

OPC is performed for one proper linear-velocity scale factor [being out of range (for example, this below adjustable range)] V1. (The technique of drawing 16) the inside of the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, or this adjustable one -- It asks for the proper record power (record power from which the set-up target beta value is obtained) P1 in the linear-velocity scale factor V1, and this record power P1 sets up in quest of the value of b used as the solution of characteristic function y=ax+b in this linear-velocity scale factor V1.

[0033] Two linear-velocity scale factors V1 and V2 lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience (The technique of drawing 17) for example, the case of Vi=10 X and Ve=16 X -- V -- 1= 4X Perform OPC by V2=8 X etc. and it asks for the proper record power (record power from which the set-up target beta value is obtained) P1 and P2 in each [these] linear-velocity scale factors V1 and V2. The sum of squares of the error of P1 and

P2 to characteristic function y=ax+b sets up in quest of the value of b used as min with a least square method. Or OPC can be performed for three or more linear-velocity scale factors lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, and it can also set up in quest of the value of b with a least square method similarly.

[0034] One linear-velocity scale factor V1 lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, and this one linear-velocity scale factor V2 within the limits (The technique of drawing 18) for example, the case of Vi=10 X and Ve=16 X -- V -- 1= 8X Perform OPC by V2=12 X etc. and it asks for the proper record power (record power from which the set-up target beta value is obtained) P1 and P2 in each [these] linear-velocity scale factors V1 and V2. The sum of squares of the error of P1 and P2 to characteristic function y=ax+b sets up in quest of the value of b used as min with a least square method. Or OPC can be performed for two or more linear-velocity scale factors lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, and this one linear-velocity scale factor within the limits, and it can also set up in quest of the value of b with a least square method similarly.

[0035] [Example 2] Example drawing 19 at the time of using the cyanine system CD-R disk (following the "disk B") of B company shows the property of the beta value of the playback RF signal to the record power at the time of changing record power variously and recording it in various linear-velocity scale factors, using Disk B. Drawing 20 shows the property of C1 error over the beta value when carrying out the EFM recovery of this playback RF signal. Drawing 21 shows the property of the pit jitter to the beta value of this playback RF signal. Drawing 22 is the property of the record power to the record linear-velocity scale factor for every beta value of having developed and searched for the property of drawing 19 . According to drawing 22 , the property of the record power to the linear-velocity scale factor at the time of maintaining and recording a beta value on a predetermined value can be approximated for linear-function y=ax+b, however a y:record power x:linear-velocity scale factor. However, according to drawing 20 and drawing 21 , in the case of Disk B, it is desirable to change the desired value of a beta value according to a record linear-velocity scale factor by one with the narrow (for the range of a beta value when C1 error and a pit jitter are low to be narrow) power margin at the time of high-speed record. The thick wire of drawing 22 shows the example of a property of the record power to the record linear-velocity scale factor when changing a beta value so that C1 error and a pit jitter may hold a small value according to a record linear-velocity scale factor. This property is expressed with quadratic function y=ax2+bx+c, and is a=-0.0217, b= 1.8169, and c= 4.408 in this example. However, the value of c changes comparatively a lot according to the wavelength of a light beam. Then, y=ax2+bx+c (a and b are immobilization and c is undecided) is beforehand memorized in memory 52 as a characteristic function of the record power to the record linear-velocity scale factor about Disk B, a test record (OPC) is performed in advance of record of acting before the audience, and the value of c is set up.

[0036] The example of the technique set up in quest of the value of c by the test record is explained.

OPC is performed for one proper linear-velocity scale factor [being out of range (for example, this below adjustable range)] V1. (The technique of drawing 23) the inside of

the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, or this adjustable one -- It asks for the proper record power (record power from which the set-up target beta value is obtained) P1 in the linear-velocity scale factor V1, and this record power P1 sets up in quest of the value of c used as the solution of characteristic function y=ax2+bx+c in this linear-velocity scale factor V1.

[0037] Two linear-velocity scale factors V1 and V2 lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience (The technique of drawing 24) for example, the case of Vi=10 X and Ve=16 X -- V -- 1= 4X Perform OPC by V2=8 X etc. and it asks for the proper record power (these linear-velocity scale factors V1 and V record power from which the target beta value set up for every two is obtained) P1 and P2 in each [these] linear-velocity scale factors V1 and V2. The sum of squares of the error of P1 and P2 to characteristic function y=ax2+bx+c sets up in quest of the value of c used as min with a least square method. Or OPC can be performed for three or more linear-velocity scale factors lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, and it can also set up in quest of the value of c with a least square method similarly.

[0038] One linear-velocity scale factor V1 lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, and this one linear-velocity scale factor V2 within the limits (The technique of drawing 25) for example, the case of Vi=10 X and Ve=16 X -- V -- 1= 8X Perform OPC by V2=12 X etc. and it asks for the proper record power (these linear-velocity scale factors V1 and V record power from which the target beta value set up for every two is obtained) P1 and P2 in each [these] linear-velocity scale factors V1 and V2. The sum of squares of the error of P1 and P2 to characteristic function y=ax2+bx+c sets up in quest of the value of c used as min with a least square method. Or OPC can be performed for two or more linear-velocity scale factors lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, and this one linear-velocity scale factor within the limits, and it can also set up in quest of the value of c with a least square method similarly.

[0039] [Example 3] Example drawing 26 at the time of using the phthalocyanine system CD-R disk (following the "disk C") of C company shows the property of the beta value of the playback RF signal to the record power at the time of changing record power variously and recording it in various linear-velocity scale factors, using Disk C. Drawing 27 shows the property of C1 error over the beta value when carrying out the EFM recovery of this playback RF signal. Drawing 28 shows the property of the pit jitter to the beta value of this playback RF signal. Drawing 29 is the property of the record power to the record linear-velocity scale factor for every beta value of having developed and searched for the property of drawing 26 . According to drawing 29 , the property of the record power to the linear-velocity scale factor at the time of maintaining and recording a beta value on a predetermined value can be approximated for linear-function y=ax+b, however a y:record power x:linear-velocity scale factor. However, according to drawing 27 and drawing 28 , in the case of Disk C, it is desirable to change the desired value of a beta value according to a record linear-velocity scale factor by one with the narrow (for the range of a beta value when C1 error and a pit jitter are low to be narrow) power

margin at the time of high-speed record. The thick wire of drawing 29 shows the example of a property of the record power to the record linear-velocity scale factor when changing a beta value so that C1 error and a pit jitter may hold a small value according to a record linear-velocity scale factor. This property is expressed with quadratic function y=ax2+bx+c, and is a=-0.0148, b= 1.4232, and c= 4.5933 in this example. However, the value of c changes comparatively a lot according to the wavelength of a light beam. Then, y=ax2+bx+c (a and b are immobilization and c is undecided) is beforehand memorized in memory 52 as a characteristic function of the record power to the record linear-velocity scale factor about Disk C, a test record (OPC) is performed in advance of record of acting before the audience, and the value of c is set up. The same technique as drawing 23 which showed Disk B - drawing 25 can be used for the technique set up in quest of the value of c by the test record.

[0040] Next, the example of the setting-out technique of the characteristic function of the record power to a record linear-velocity scale factor when the optical disk which is not memorized by memory 52 is inserted is explained.

Two linear-velocity scale factors V1 and V2 lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience (The technique of drawing 30) for example, the case of Vi=10 X and Ve=16 X -- V -- 1= 4X OPC is performed by V2=8 X etc., it asks for the proper record power (record power from which the set-up target beta value is obtained) P1 and P2 in each [these] linear-velocity scale factors V1 and V2, and these [P1 and P2] set up in quest of characteristic function y=ax+b used as a solution. or three or more linear-velocity scale factors lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience -- OPC -- carrying out -- a least square method -- the characteristic function y=ax+b whole -- asking -- or -- this -- between three or more proper record power values can be connected with a straight line or a curve, and it can also set up in quest of a characteristic function by straight-line approximation or curvilinear approximation.

[0041] One linear-velocity scale factor V1 lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience, and this one linear-velocity scale factor V2 within the limits (The technique of drawing 31) for example, the case of Vi=10 X and Ve=16 X -- V -- 1= 8X OPC is performed by V2=12 X etc., it asks for the proper record power (record power from which the set-up target beta value is obtained) P1 and P2 in each [these] linear-velocity scale factors V1 and V2, and these [P1 and P2] set up in quest of characteristic function y=ax+b used as a solution. or two or more linear-velocity scale factors lower than the adjustable range (Vi-Ve) of the linear-velocity scale factor used at the time of record of acting before the audience and this one linear-velocity scale factor within the limits -- OPC -- carrying out -- a least square method -- the characteristic function y=ax+b whole -- asking -- or -- this -- between three or more record power values can be connected with a straight line or a curve, and it can also set up in quest of a characteristic function by straight-line approximation or curvilinear approximation. In addition, with the gestalt of operation, although the beta value was used as a parameter about regenerative-signal grace, the parameter about the regenerative-signal grace of CI error, a pit jitter, or others can also be used in the first half.

[Translation done.]